



# Calorimeter Regional Trigger Simulation

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CMS CPT Week Trigger Meeting  
24 April 2001

**ORCA L1CaloTrigger  
Production at Wisconsin  
New Results from UW Production  
New Results from FNAL Production**



# Status of ORCA L1CaloTrigger code

**Latest version tag: Dasu22March2001**

- Adds missing  $E_T$  x and y component to L1GlobalSum
- Added e/ $\gamma$  corrections readout by CMSIM Version

**Soon:**

- Jet Corrections included in code

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# RCT Simulation

## New simulation note:

- *CMS Level-1 Regional Calorimeter Trigger Simulation Results*
- CMS NOTE 2000/074
- Expands results in Chapter 3 of Trigger TDR
  - Additional results/plots
  - More detailed description

## Working on UW simulation production:

- have created local Objectivity DB and federation
- analyzing data generated with CMS120

## Analyzing data on the FNAL Federation:

- Jobs run at Wisconsin!
- No local DB copy
- Accessed via network (fast connection to FNAL)



# Wisconsin MC Production



## Using UW Condor system (see <http://www.cs.wisc.edu/condor/>)

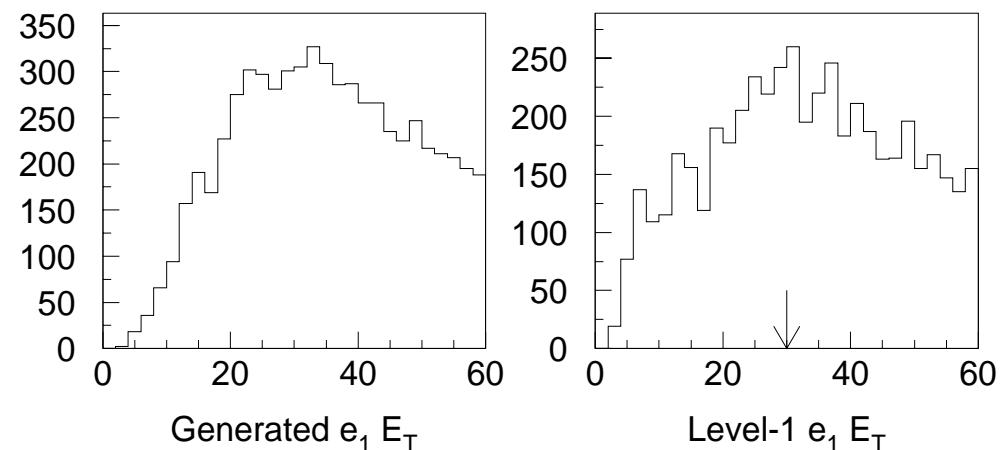
- submitted from local machine → sees local disks
- 1.2 TB RAID for storage
- 20 local CPUs - 5 are Objectivity servers
- Additional 600+ CPUs accessible in Condor pool
- Condor used for CMSIM and WriteDigis
- WriteHits done on local CPU's
- Production Coordinator: Raj Rajamani
- Have received random seeds for Spring Production
- Have created own level-1 datasets (& own minbias):
  - have Digits for  $t \rightarrow eX$ ,  $Z^0 \rightarrow ee$ ,  $W^\pm \rightarrow e\nu$
  - CMSIM 120 and ORCA\_4\_4\_0\_optimised
  - cards at [http://hep.wisc.edu/~pamc/Templates/l1\\*.tit](http://hep.wisc.edu/~pamc/Templates/l1*.tit)
  - want to add  $t \rightarrow jets$  and more...
  - results on following pages



# $t \rightarrow eX$ Results

| Trigger                                       | Indiv. | Cumul. |
|---|--------|--------|
| $i\text{e}_1 > 30 \parallel n\text{e}_1 > 55$ | 0.66   | 0.66   |
| $i\text{e}_2 > 15 \parallel n\text{e}_2 > 25$ | 0.17   | 0.69   |
| $\tau_1 > 150$                                | 0.26   | 0.74   |
| $\tau_2 > 80$                                 | 0.39   | 0.78   |
| $j_1 > 250$                                   | 0.05   | 0.78   |
| $j_2 > 200$                                   | 0.03   | 0.78   |
| $j_3 > 100$                                   | 0.14   | 0.78   |
| $j_4 > 80$                                    | 0.14   | 0.78   |
| $j_1 > 150 \&\& i\text{e}_1 > 15$             | 0.24   | 0.79   |
| $\tau_1 > 90 \&\& i\text{e}_1 > 15$           | 0.55   | 0.82   |
| Missing ET > 150                              | 0.01   | 0.82   |
| MET > 100 $\&\&$ $i\text{e}_1 > 15$           | 0.04   | 0.83   |
| MET > 100 $\&\&$ $j_1 > 80$                   | 0.06   | 0.83   |
| Total ET > 1000                               | <0.01  | 0.83   |
| Total   | N/A    | 0.83   |

UW produced dataset:  
**I1\_topelec**  
 $\mathcal{L} = 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$   
**10000 events**  
 $|m_{\text{generated } e_1}| < 2.5$





# Z<sup>0</sup>→ee Results

| Trigger               | Indiv. | Cumul. |
|-----------------------|--------|--------|
| ie1 > 30    ne1 > 55  | 0.77   | 0.77   |
| ie2 > 15    ne2 > 25  | 0.72   | 0.88   |
| τ1 > 150              | 0.01   | 0.88   |
| τ2 > 80               | 0.08   | 0.88   |
| j1 > 250              | 0.00   | 0.88   |
| j2 > 200              | 0.00   | 0.88   |
| j3 > 100              | 0.00   | 0.88   |
| j4 > 80               | 0.01   | 0.88   |
| j1 > 150 && ie1 > 15  | 0.01   | 0.88   |
| τ1 > 90 && ie1 > 15   | 0.23   | 0.90   |
| Missing ET > 150      | 0.00   | 0.90   |
| MET > 100 && ie1 > 15 | 0.01   | 0.90   |
| MET > 100 && j1 > 80  | 0.01   | 0.90   |
| Total ET > 1000       | 0.00   | 0.90   |
| Total                 | N/A    | 0.90   |

UW produced dataset:

I1\_z\_ee

$\mathcal{L}=10^{34} \text{ cm}^{-2} \text{ s}^{-1}$

373 events

$|n_{e1}| < 2.5$  and  $|n_{e2}| < 2.5$



# W $\rightarrow$ ev Results

UW produced dataset: I1\_w\_enu

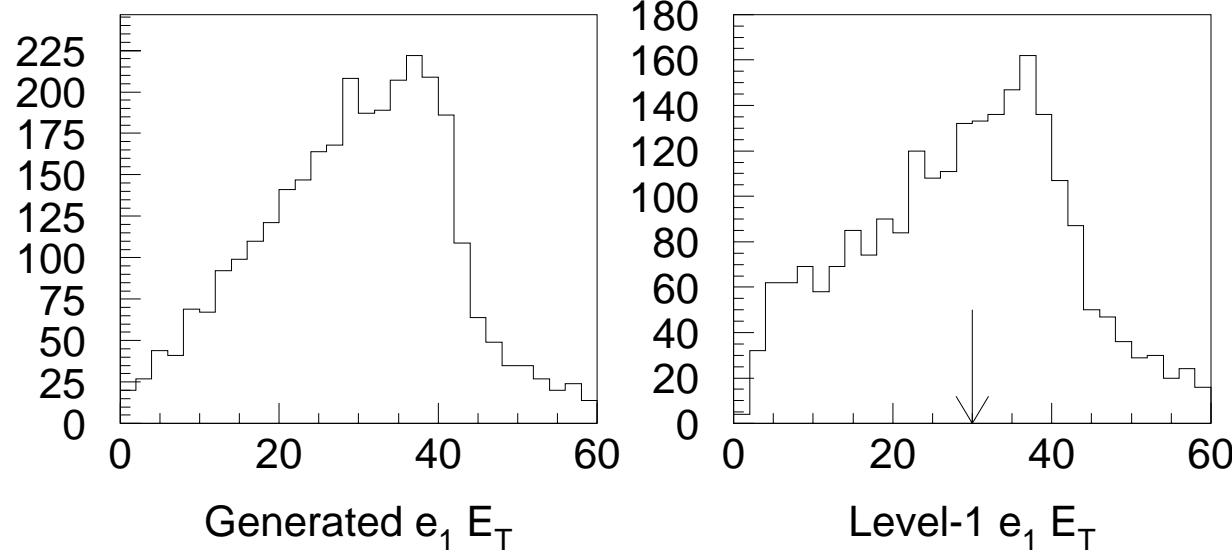
$\mathcal{L}=10^{34} \text{ cm}^{-2} \text{ s}^{-1}$  and 5000 events

$|n_{e1}| < 2.5$

48% (nearly all from  
single electron trigger)

$|n_{e1}| < 2.5 \text{ } \& \text{ } E_{Te1} > 25 \text{ GeV}$

$\rightarrow$  69%





# Charged higgs: $h^+$

| Trigger                       | Indiv. | Cumul. |
|-------------------------------|--------|--------|
| $ie1 > 30 \parallel ne1 > 55$ | 0.21   | 0.21   |
| $ie2 > 15 \parallel ne2 > 25$ | 0.02   | 0.21   |
| $\tau_1 > 150$                | 0.57   | 0.65   |
| $\tau_2 > 80$                 | 0.57   | 0.79   |
| $j_1 > 250$                   | 0.14   | 0.81   |
| $j_2 > 200$                   | 0.08   | 0.81   |
| $j_3 > 100$                   | 0.31   | 0.82   |
| $j_4 > 80$                    | 0.19   | 0.83   |
| $j_1 > 150 \&& ie1 > 15$      | 0.10   | 0.83   |
| $\tau_1 > 90 \&& ie1 > 15$    | 0.14   | 0.84   |
| Missing ET $> 150$            | 0.03   | 0.84   |
| MET $> 100 \&& ie1 > 15$      | 0.02   | 0.84   |
| MET $> 100 \&& j_1 > 80$      | 0.18   | 0.85   |
| Total ET $> 1000$             | <0.01  | 0.85   |
| Total                         | N/A    | 0.85   |

$h^+ \rightarrow \tau\text{-jet} + \cancel{E}_T + jjj$

Dataset at FNAL: jm\_hplus\_m200\_1034

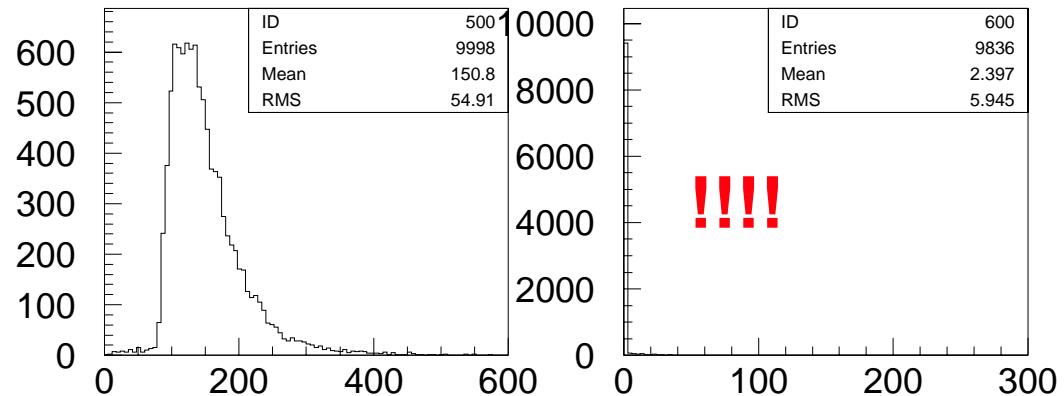
Using New  $\tau$  trigger algorithm

Cuts from TDR Trigger Table for High Luminosity  
Jet energies corrected using Sylvia's corrections.

Cut on generated  $\tau$ 's  $|\eta| < 2.5$

Plenty of real  $\tau$ 's:

e/ $\gamma$  trigger efficiency for hplus-separate-em5hd5 at  $10^{34} \text{ cm}^{-2}\text{s}^{-1}$





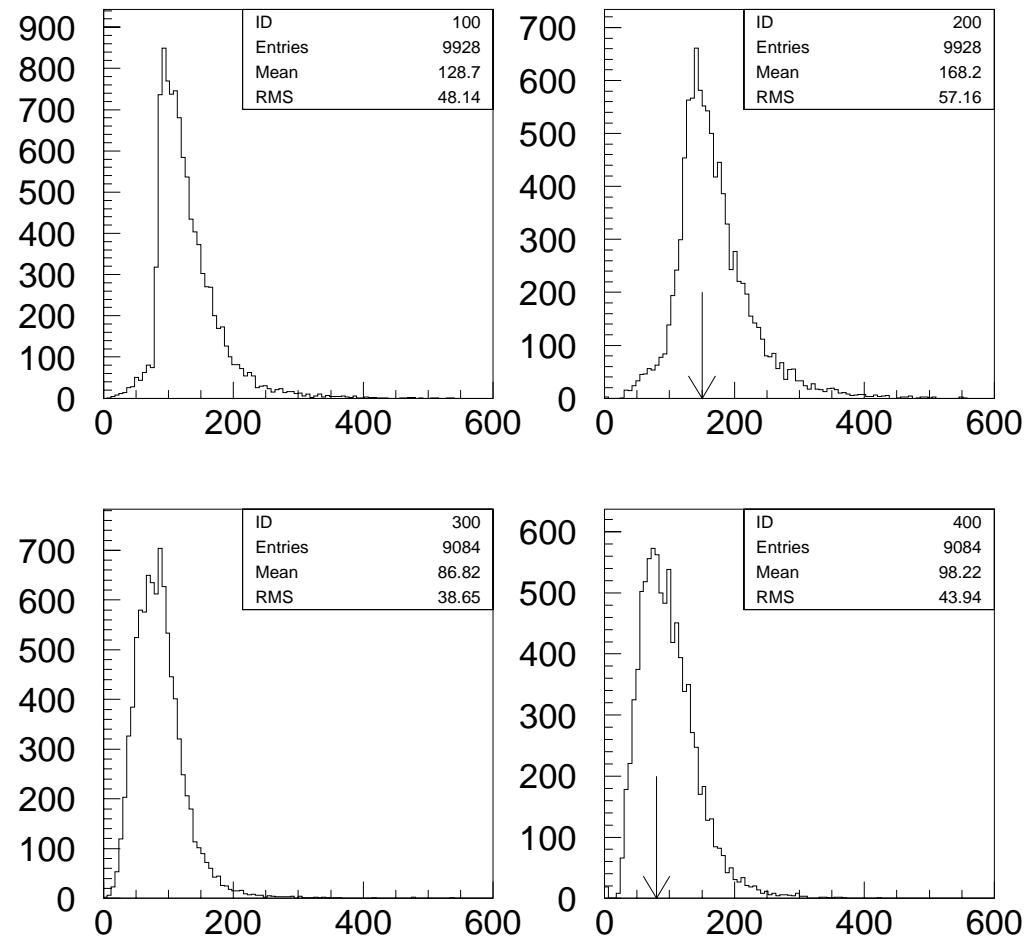
# Charged higgs: $h^+$ (2)

Generated jets  
matched to  
 $\tau$ -jets:  $\Delta R < 0.5$

Soft jets below jet  
cutoff of 200 GeV  
captured by  $\tau_2$

Rate still needs  
to be studied

e/ $\gamma$  trigger efficiency for hplus-separate-em5hd5 at  $10^{34} \text{ cm}^{-2}\text{s}^{-1}$

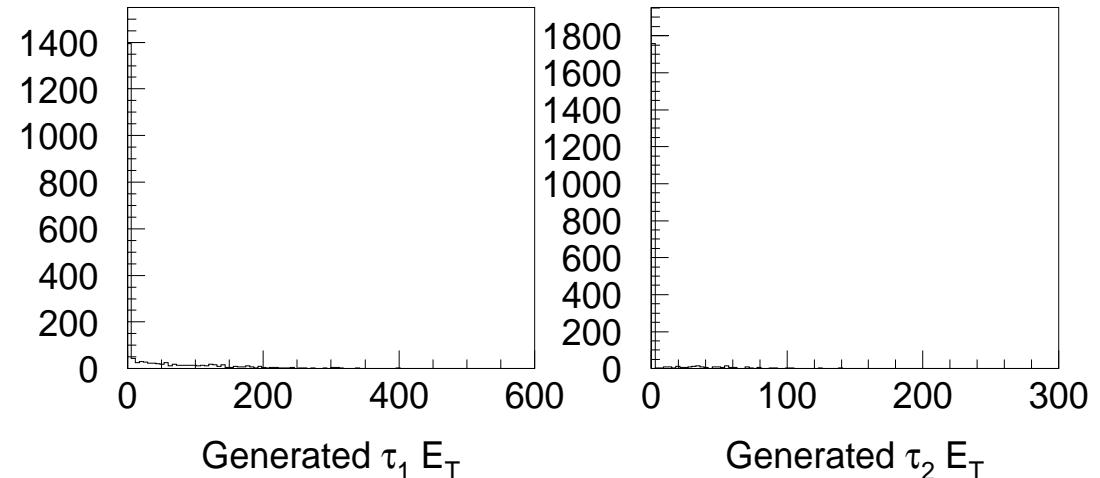




# mSUGRA

| Trigger                     | Indiv. | Cumul. |
|-----------------------------|--------|--------|
| ie1 > 30    ne1 > 55        | 0.16   | 0.16   |
| ie2 > 15    ne2 > 25        | 0.04   | 0.17   |
| $\tau_1 > 150$              | 0.52   | 0.58   |
| $\tau_2 > 80$               | 0.54   | 0.71   |
| j1 > 250                    | 0.53   | 0.84   |
| j2 > 200                    | 0.41   | 0.85   |
| j3 > 100                    | 0.63   | 0.88   |
| j4 > 80                     | 0.51   | 0.88   |
| j1 > 150 && ie1 > 15        | 0.18   | 0.89   |
| $\tau_1 > 90 \&\& ie1 > 15$ | 0.18   | 0.89   |
| Missing ET > 150            | 0.07   | 0.89   |
| MET > 100 && ie1 > 15       | 0.04   | 0.89   |
| MET > 100 && j1 > 80        | 0.17   | 0.90   |
| Total ET > 1000             | 0.05   | 0.90   |
| Total                       | N/A    | 0.90   |

Dataset at FNAL:  
jm\_msugra2\_1034  
sign of  $\mu$  is positive  
 $\tan\beta=10$   
 $A_0 = 0$   
 $m_{1/2} = 420 \text{ GeV}$   
 $m_0 = 520 \text{ GeV}$   
Not many real  $\tau$ 's:

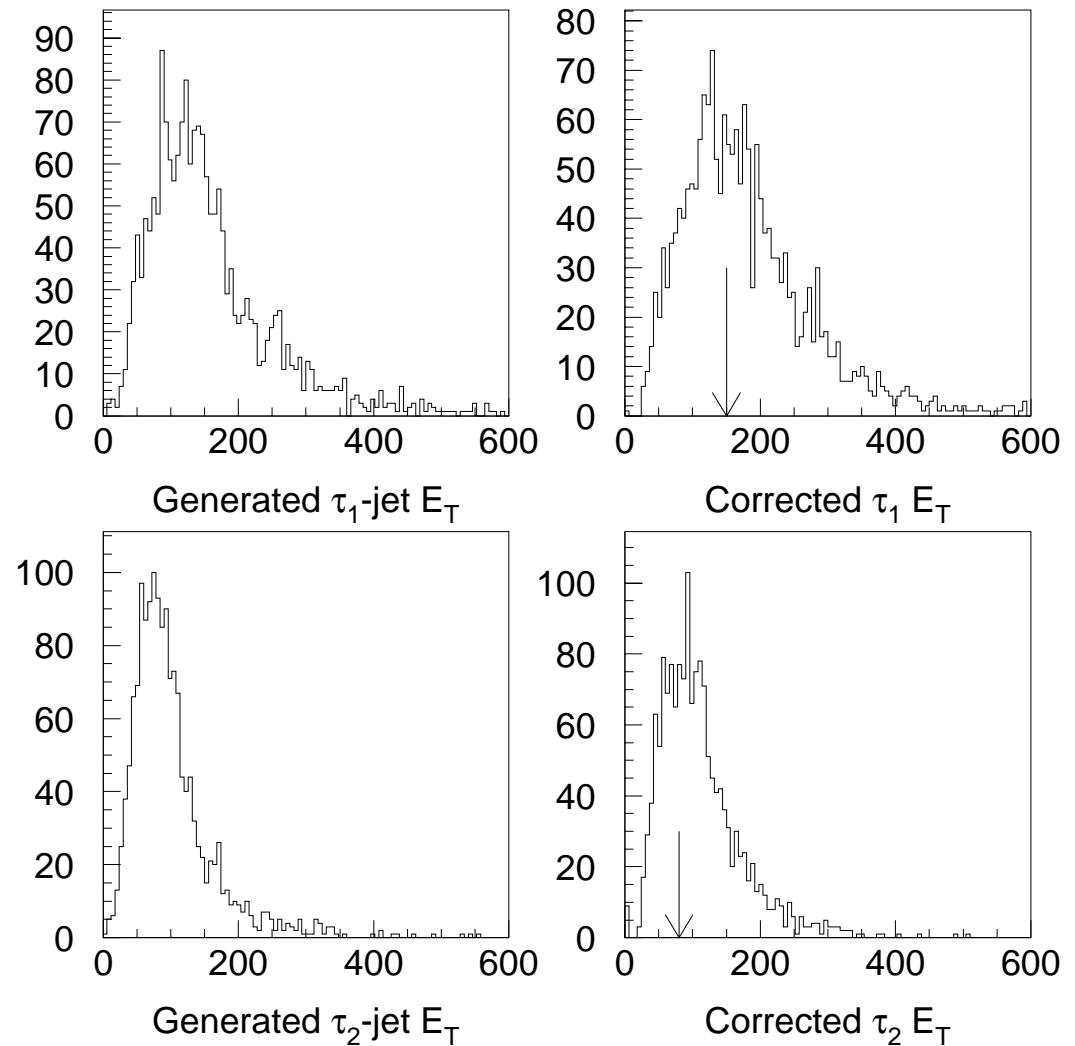




# mSUGRA (2)

Generated jets  
matched to  
 $\tau$ -jets:  $\Delta R < 0.5$

Lower energy  
jets below jet  
cutoffs captured





# mSUGRA'

| Trigger                     | Indiv. | Cumul. |
|-----------------------------|--------|--------|
| ie1 > 30    ne1 > 55        | 0.16   | 0.16   |
| ie2 > 15    ne2 > 25        | 0.04   | 0.17   |
| $\tau_1 > 150$              | 0.52   | 0.58   |
| $\tau_2 > 80$               | 0.54   | 0.71   |
| j1 > 250                    | 0.53   | 0.84   |
| j2 > 200                    | 0.41   | 0.85   |
| j3 > 100                    | 0.63   | 0.88   |
| j4 > 80                     | 0.51   | 0.88   |
| j1 > 150 && ie1 > 15        | 0.18   | 0.89   |
| $\tau_1 > 90 \&\& ie1 > 15$ | 0.18   | 0.89   |
| Missing ET > 150            | 0.07   | 0.89   |
| MET > 100 && ie1 > 15       | 0.04   | 0.89   |
| MET > 100 && j1 > 80        | 0.17   | 0.90   |
| Total ET > 1000             | 0.53   | 0.90   |
| Total                       | N/A    | 0.90   |

Dataset at FNAL:  
**jm\_msugra3\_1034**  
**sign of  $\mu$  positive**  
 **$\tan\beta=10$**   
 **$A_0 = 0$**   
 **$m_{1/2} = 1000 \text{ GeV}$**   
 **$m_0 = 400 \text{ GeV}$**

Similar to jm\_msugra2\_1034



# qqh, h->bb, (qq from ZZ or WW fusion)

Francesca analysed datasets at FNAL:

- jm\_sm\_qq\_qqhXXX\_bb\_1034
- jm\_sm\_qq\_qqhXXX\_bb\_nopileup
  - XXX=higgs masses of 110 and 130 GeV

Cuts imposed:

- $|\eta_{\text{jet1}}| < 2.5$   $|\eta_{\text{jet2}}| < 2.5$
- $E_{T\text{jet1}} > 60 \text{ GeV}$   $E_{T\text{jet2}} > 40 \text{ GeV}$

Results:

- High Luminosity:
  - 110 GeV 40% (j, $\tau$  triggers only) 43% (all)
  - 130 GeV 38% (j, $\tau$ ) 41% (all)
- Low Luminosity (No Pileup):
  - 110 GeV 84% (j, $\tau$ ) 90% (all)
  - 130 GeV 83% (j, $\tau$ ) 90% (all)



# Summary

## New RCT simulation document

- CMS NOTE 2000/074

## L1CaloTrigger Simulation Updated Steady progress on production

- have produced own datasets at UW
- Analysed new Digs of  $t \rightarrow eX$ ,  $W \rightarrow ev$ ,  $Z \rightarrow ee$
- continuing on additional sets  $t \rightarrow jets$ , etc.

## New simulation results using FNAL DB

- $h^+$ , mSUGRA,  $h \rightarrow bb$

## Need soon:

- QCD for rates, high  $\mathcal{L}$  and low  $\mathcal{L}$